Newsletter

University of Malaya-Kyoto University Secretariat

Kyoto University
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JSPS Asian Core Program (IWM)

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*The 4th **Comprehensive Symposium (CS4)** was held successfully at Faculty of Biosciences and Medical Engineering (FBME),UTM Skudai, Johor, Malaysia on 3-4 December 2014. Fifty five participants from Malaysia and 28 participants from Japan attended the symposium.*

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The Late Prof. Taniguchi (Konan University)

*The **Fumiaki Taniguchi Memorial Award** given by Prof. Dr. Azlan Abdul Rahman (Deputy Vice Chancellor of Development, UTM) to the recipients:*
(a) The Water Warriors Team (University of Malaya)
(b) Ms. Riwa Watanabe (Konan University)
(c) Mr. Masao Amano (Konan University)

University of Malaya-Kyoto University Secretariat is an international program under:

UNIVERSITY OF MALAYA
SUSTAINABILITY SCIENCE CLUSTER

JSPS Asian Core Program
4th Comprehensive Symposium (CS4)

3-4 December 2014

Faculty of Biosciences and Medical Engineering, UTM Skudai, MALAYSIA

The 4th Japanese Society for the Promotion of Science Asian Core Program Comprehensive Symposium (CS4) was held in UTM Skudai, Johor on 3rd and 4th of December 2014. The JSPS Asian Core Program is an international collaboration between Japanese and Malaysian universities under the research theme of "Research and Education Centre for the Risk Based Asian Oriented Integrated Watershed Management." The JSPS-ACP Comprehensive Symposium is an annual event, with University of Technology Malaysia (UTM) co-hosting the symposium for this year. The 4th symposium was held at Block V01, Faculty of Biosciences and Medical Engineering (FBME), UTM Skudai, Johor. A total of 83 participants (55 Malaysian and 28 Japanese delegates) comprising the coordinators and group leaders as well as academicians, researchers and students attended the event. On 3rd December 2014, Asian Core Program Coordinators; Prof. Nik Meriam Nik Sulaiman (University of Malaya) delivered her welcome remark followed by Prof. Yoshihisa Shimizu (Kyoto University). The event continued with the keynote speech by Datuk Paduka Dr. Ir. Hj. Keizrul bin Abdullah, the Chairman of Wetlands International Malaysia with title; *Bridging the Gap between Science and Practices of River Basin Management*.

On the same day, two invited speakers delivered their speeches; Prof. Dr. Mohamad Pauzi Zakaria, Head of Environmental Forensics Research Centre (ENFORCE) from Universiti Putra Malaysia (UPM) on *Challenges in River and Water Pollution in Malaysia* and Prof. Minoru Yoneda, Kyoto University on *Over-watershed-scale Pollution by Radioactivity in Fukushima: Situation, Decontamination and Failure in Risk Communication*. Photo session took place after the dialogue session. The poster presentation session was held during lunch break with 49 participants from Malaysia and Japan. The afternoon session preceded with a dialogue session attended by stakeholders from Malaysia and Japan, namely, Prof. Dr. Maketab Mohamed (UTM), Tn. Hj. Abdul Rashid A. Rahman (Director of BAKAJ), Mr. Boyd Dionysius Joeman (Senior Vice president of IRDA), Tn. Hj. Lukman Abu Bakar (Deputy Director II, UPENJ) and Prof. Yoshihisa Shimizu (ACP Coordinator, Japan). Moderator for the dialogue session was Prof. Zulkifli Yusop from UTM. In the evening, the participants attended symposium dinner held at Grand Straits Garden Seafood Restaurant as the final event for day one.

***(a)** Prof. Nik Meriam (Malaysian Coordinator) giving her welcome remark **(b)** The invited speaker (Malaysia): Prof. Mohamad Pauzi **(c)** The invited speaker (Japan): Prof. Minoru Yoneda **(d)** Prof. Shimizu (Japanese Coordinator) giving his welcome remark **(e)** Datuk Paduka Dr. Ir. Hj. Keizrul Abdullah during his keynote speech **(f)** The dialogue session **(g)** The poster session*

Selangor River Watershed

Langat River Watershed

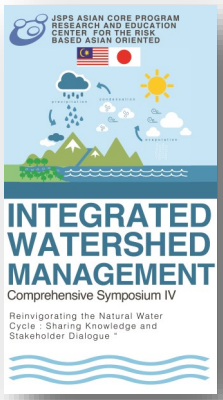
Johor River Watershed

On the 4th of December 2014, the participants were divided into three different Malaysian watershed for group discussion. Leaders from each country for group discussion were as below:

Selangor River Watershed
Prof. Yoshihisa Shimizu (KU)
Prof. Nik Meriam Nik Sulaiman (UM)

Langat River Watershed
Prof. Minoru Yoneda (KU)
Prof. Md. Ghazaly Shaaban (UM)

Johor River Watershed
Prof. Eiichi Nakakita (KU)
Prof. Zulkifli Yusop (UTM)



Following the group discussion, a representative from each group presented their resolution to all participants. The symposium officially ends after closing remark by Prof. Nik Meriam Nik Sulaiman and Prof. Yoshihisa Shimizu.

(a) Dr. Noorul Hassan Zardari from UTM presenting a summary from the dialogue session (b) Representative from Johor Watershed, Assoc. Prof. Sunmin Kim (Kyoto University) presenting their outcome from the group discussion.

(c) Prof. Dr. Azlan Abd. Rahman receiving a token of appreciation from ACP Program. (d) Prof. Nik Meriam given a speech during the symposium dinner
(e) Performance of Dikir Barat by UTM students singing a Japanese song "Miraie".

(f) ACP merchandise to MPJB representative (left). (g) The Japanese delegates share a moment together with residents at Sg. Sebulong (site visit on the second day). (h) A photo of Sungai Sebulong behind the resident houses.

The Coordinating Universities (Kyoto University and University of Malaya) has decided to appreciate the contribution of ACP members in field of environmental ethics and environmental education. Therefore an award has been created:

Fumiaki Taniguchi Memorial Award

In recognition of individuals like Prof. Fumiaki Taniguchi (Konan University) who devoted his life time to make exemplary contribution in field of environmental ethics and environmental education.

Recipient of the award:

◊ **Water Warriors Team** *(University of Malaya)*

Dr. Zeeda Fatimah Mohamad
Dr. Nobumitsu Sakai
Affan Nasaruddin
Siti Norasiah Abdul Kadir
Benjamin Sia Ming Ong

◊ **Ms. Riwa Watanabe** *(Konan University)*

◊ **Mr. Masao Amano** *(Konan University)*

甲南大学 KONAN UNIVERSITY

Outstanding Poster Presentation

Forty nine posters (23 from Japan and 26 from Malaysia) presented during CS4 and the panel judges decided to award top ten the highest mark as the Outstanding Posters.

The winners are:

Assoc. Prof. Dr. Zarina Othman *(Universiti Kebangsaan Malaysia)*
Prof. Lee Yook Heng *(Universiti Kebangsaan Malaysia)*
Mr. Jasni Yaakub *(Universiti Kebangsaan Malaysia)* (Photo: g)
Dr. Ikuko Bamba *(Kinki University)* (Photo: d)
Mr. Redzuan Ramli *(University of Malaya)* (Photo: b)
Assoc. Prof. Izumi Mori (*Okayama University*) (Photo: a)
Dr. Zul Ilham Zulkiflee Lubes *(University of Malaya)* (Photo: e)
Dr. Kentaro Misaki *(Kyoto University)* (Photo: f)
Assoc. Prof. Hiroshi Yamamoto *(Tokushima University)* (Photo: h)
Mr. Junichi Shirasaka *(Kyoto University)* (Photo: c)

The adjudicators for poster session.

Landuse Conflicts In The Sungai Selangor Watershed

Selangor River Watershed, MALAYSIA

Nursyazla Binti Sulaiman
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University of Malaya, 50603
Kuala Lumpur MALAYSIA

Prof. Dr. Jamilah Mohamad
Department of Geography,
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Introduction

Rapid land use changes have taken place in many regions of Malaysia over the past decades. Physically, Sungai (meaning river) Selangor basin is the third largest basin among seven river basins in Selangor state after Sungai Bernam basin and Sungai Langat basin. Sungai Selangor begins from the upper stream at Fraser's Hill in Pahang to the lowlands of Kuala Selangor before meeting the Straits of Melaka. The basin has an area of approximately 2,200 km^2 which is a quarter of Selangor State with the major tributaries including Sungai Kerling, Sungai Sembah, Sungai Batang Kali, Sungai Rening, Sungai Luit, Sungai Kul, Sungai Gumut, Sungai Darah, Sungai Kubu, Sungai Gerachi, Sungai Peretak and Sungai Tinggi (Laporan Sungai Negeri Selangor, 2008). In the period from 1993 to 2010, patterns of land use in Selangor state has undergone a drastic transformation due to land development for purposes of agricultural and urban expansion such as Shah Alam, Petaling Jaya, Klang, Bestari Jaya and Rawang. This research is conducted to review the land use pattern and changes in the Sungai Selangor watershed and to identify the resulting conflicts in the Sungai Selangor watershed.

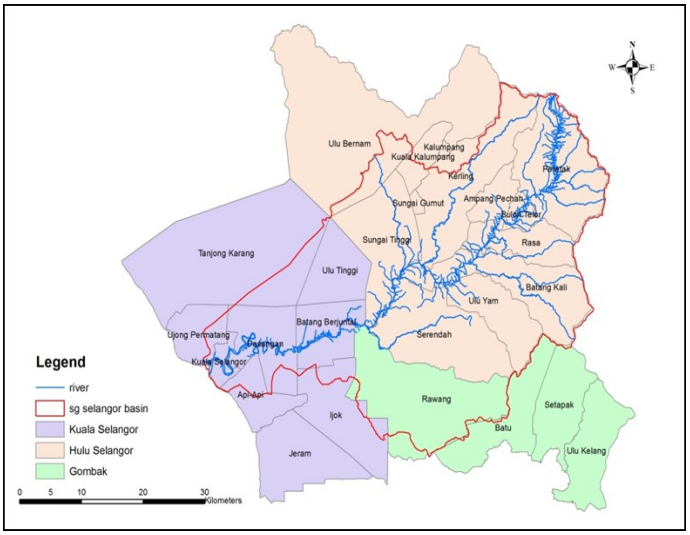


Figure 1 : Sungai Selangor Watershed

Results and Discussion

There are two water quality stations in Sungai Selangor which are Ampang Pechah station and Rantau Panjang station with total catchment areas of 321 km2 and 1450 km2 respectively (DID, 2013). Figure 1 show the Sungai Selangor watershed which flows from the foothills of Fraser's Hill to the downstream area at Kuala Selangor.

- **Land Use Pattern (1993 – 2010)**

Table 1 shows the land use types of Selangor state and land use status by districts with most of the area in the districts for agricultural use and permanent forest reserves.

Table 1 : Type of Land Use in Northern Selangor, 1993

District	Agricultural	Residential	Industrial	Mining	Permanent Protected Forest	Aboriginal Peoples Reserves	Government Land	Others	Total
Gombak	7520	2893	8936	-	29,640	235	15,784	-	65,008
Kuala Selangor	57,567	4878	301	1905	50,059	-	3134	-	117,844
Hulu Selangor	73,335	2423	4655	6420	77,596	2277	7340	-	174,047
Selangor	355,422	31,686	20,128	12,080	236,066	7848	15,574	67,360	796,084

Source : Edited from Statistics Department of Selangor Darul Ehsan, 1993

In 2010, as indicated in Table 2, the Town and Country Planning Department has classified land use into twelve classes including residential, business and services, industrial, institutional and facilities, recreational, infrastructure and utilities , forest, water body, agricultural, transportation, vacant land and aquaculture. The largest land use for Kuala Selangor is agricultural land (20711.19 hectare) followed by forests areas (5178.16 hectare) and vacant land (3039.73 hectare). In Hulu Selangor district, 56% of the total land area is forest and 29% is under agriculture. Similarly in Selayang district, the largest area of land use is forest, agricultural and vacant land.

Table 2 : Type of Land Use in Selangor, 2010

Land Use	Area (Hec)		
	Kuala Selangor	Hulu Selangor	Selayang
Residential	743.78	2984.10	1633.31
Business and services	41.29	202.83	120.00
Industrial	138.62	1285.34	965.36
Institutional and facilities	390.76	637.71	688.51
Recreational	446.32	1673.44	2175.10
Infrastructure and utility	282.06	255.27	552.93
Forest	5178.16	72829.84	7858.43
Water body	1933.77	3618.65	360.43
Agricultural	20711.19	37213.49	7509.43
Transportation	1308.74	4383.71	1963.06
Empty land	3039.73	4106.31	2682.63
Aquaculture	-	517.44	69.41
TOTAL	34214.42	129708.13	26578.6

Source : Selangor, Town and Country Planning Department, 2010

- **Potential Conflicts Areas**

Human activities within a river basin, such as forest clearing, intensive and extensive agricultural practices, and urbanization alter the ambient chemistry of river water and the river capacity. All these factors contribute significantly to the increase in concentration downstream (Lai, 1983). Apart from that, most of the human activities in the basin affect water quality, directly through discharge of sewage and other wastewater, or indirectly, through land use changes. A change in land use or land cover in association with seasonal and location variation significantly affected stream water quality (Tsegaye et al. 2006; Fulazzaky, Teng Wee Seong and Mohd Idrus, 2010). Domestic, agricultural, and industrial waste discharges continue to pollute the rivers, directly through surface runoff and indirectly through drains and river tributaries (Gazzaz et.al 2012). Besides that, according to LUAS (2009) the catchment of Sungai Selangor also was constantly threatened by human activities (for example refer to Figures 2 and 3). Rawang town is also one of the potential conflict area in the Sungai Selangor watershed. According to The Star (2014), the rapid development, changing river alignments and lack of enforcement from Drainage and Irrigation Department's (DID) has led to many businesses and industries ending up beside the river. The rate of river water contamination and illegal dumping has increased tremendously over time.

Figure 2 : Waste disposal direct into the river at Sungai Selangor area.
(source : The Star Online, 2014)

Figure 3 : A garbage truck waiting to be washed at the district council facility situated right on DID reserve land next to Sungai Kubu, in Kuala Kubu Baru.
(source : The Star Online, 2014)

Figure 4 : Waste disposal at Sungai Selangor area in Rawang.
(source : by researcher)

Figure 5 : Students carry out water quality study at Sungai Selangor area in Rawang. The area is near to the activity of agriculture and farming.
(source : by researcher)

Conclusion

Developments in Sungai Selangor watershed which are located close to the small river tributaries have resulted in all the sedimentation and pollution from those developments entering into the river system. In sum, serious conflicts have arisen in Sungai Selangor watershed because of the increasing interactions between man and the environment. The fertile soil along the river basin or in the watershed can contribute to many types of activities, eg. agriculture and plantation which contributes to the economy. It is also a land that is experiencing competition for its natural resources that are already under stress and that could be lost to us in the absence of a widespread awareness of their existence, their significance and their value. The increasing development within Sungai Selangor watershed, demonstrated that a convergence of population into built-up areas has modified the natural environment and made it more vulnerable to a greater range of hazards. Land use conflicts must be addressed in order to generate good environment within the watershed.

Hence, the further plan of this research is to explore more about the land use conflict and anthropogenic activities that has happened within the buffer zone of Sungai Selangor, focusing on the area around Rawang town. The objectives of the future study would be to identify the anthropogenic activity in the Sungai Selangor buffer zone using GIS and Remote Sensing analysis, to identify the level of water quality of Sungai Selangor, and to study recommendations to overcome the outstanding issues regarding pollution of Sungai Selangor.

Messages from Supervisor (Prof. Dr. Jamilah Mohamad)

"Increasingly, watersheds have become widely recognized as the best scale at which to govern water. Water governance involves, amongst others, about making decisions on how water is to be used and allocated. Various policy reforms have suggested a move away from political boundaries towards hydrologic ones for the purposes of water governance. Cohen (2010) summarized that the policy rationales for this shift are threefold: (a) watersheds are natural (b) watersheds are integrative and (c) watersheds are participatory. The Sungai Selangor watershed provides an interesting case study of watershed management due to various conflicting land uses, problems of water shortage and conflicts of interest among multiple stakeholders as the river flows through the three separately-administered districts of Hulu Selangor, Gombak, and Kuala Selangor. While the middle stream receive pressure from urbanization activities, the lower stream remains as an important ecological system, hosting a large firefly colony and serving as an important tourism destination. Hence, appropriate governance mechanisms would involve addressing issues of resource management decisions, actions of various stakeholders, and how actors should be held accountable for their decisions.

Evaluation of Microorganism Pollution in Selangor River Watershed, Malaysia

2013 - 2014

Selangor River, MALAYSIA

Prof. Yoshihisa Shimizu
Research Center for Environmental Quality Management, Department of Environmental Engineering, Kyoto University

Mr. Takashi Kondo
Research Center for Environmental Quality Management, Department of Environmental Engineering, Kyoto University

Introduction and Objectives

Humans cannot live without water, and safe water access is considered to be essential for increasing living standards. A concept "Integrated Watershed Management" has been advocated to achieve sustainable development and access of safe water simultaneously. In this research, Geographical Information System (GIS)-based simulation was conducted in the watershed model and utilized to materialize the concept. The model needs various kinds of environmental information in the watershed such as elevation, land use, soil description, weather and observed water quality/quantity data. Calibration must be performed through comparing observed and calculated data. The accuracy of the model depends on the calibration, and more observed data help to create model and to conduct simulation more accurately. The simulation is used to evaluate the effects of some countermeasures since it can predict the result of future scenario. Therefore, the GIS-based simulation eventually leads to sustainable development and safe water access.

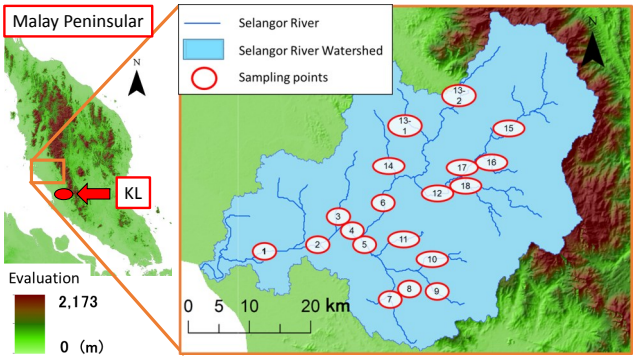


Figure 1 Sampling in Selangor River Watershed.

In this research, two specific objectives were set. One was to investigate water safety in Kuala Lumpur (KL), and another was to evaluate improvements of microorganism pollution by some countermeasures. The GIS-based simulation helps to achieve second specific objective by predicting the improvement result. The microorganism pollution should be controlled for achieving water safety since it causes acute illness such as stomach-ache and diarrhea. Selangor River was selected in this research as the river is one of the main sources of drinking water supply in KL. A number of river water samples in Selangor River Watershed were collected, and *E.coli* concentrations were measured to clarify the microorganism pollution. The GIS-based simulation and its calibration were carried out using these observed data and further utilized to predict the effect of future scenario with countermeasures.

Messages from Supervisor (Prof. Yoshihisa Shimizu)

"This research is considered to be one of the first results to reveal the actual river water pollution by bacteria in Malaysia. Also it indicated that there are so many countermeasures must be set and carried out for its improvement for safe drinking water supply and healthy environment. Mr. Kondo who was a senior student when he conducted the research started from nothing. He investigated the methodology to measure E.coli, formulated the sampling plan, leads other persons to analyze samples, and studied/formulated the GIS-based simulation model. Now being a graduate student, I strongly expect him to surprise us more".

Remarks

"I would like to appreciate strong and kind supports from many persons. First of all, I would like to appreciate all the kind support and help by Professor Dr. Nik, Professor Dr. Md. Ghazaly, Dr. Ghufran, Mr. Mohd Izziuddin, Ms. Kalai and all the relevant staffs in faculty of Science and Engineering of UM, and also Professor Dr. Maketab in UTM. Also, I would like to thank Professor Dr. Salman, Dr. Zeeda, Mr. Mohd Noor, Mr. Affan, Ms. Nadhiah, Mr. Mohd Redzuan, and Mr. Azizi for all the kind support to make my stay in Malaysia fabulous. Second, I would like to say thank you very much for all the relevant staffs in Department of Veterinary Services in Malaysia, Pn. Marni, En. Roslan, Pn. Rorzela, and so on. Thanks to their kind support, I was able to conduct the GIS-based simulation about microorganism pollution. Finally, I would like to say great thank you to Dr. Sakai for his big support from the beginning to the end. I also would like to say thank you to his wife, Ms. Mika Sakai and their daughter, Ms. Ritsuki Sakai for nice hospitality at their house. This research has been carried out through Asian Core Program (ACP) supported by JSPS and MOE of Malaysia".

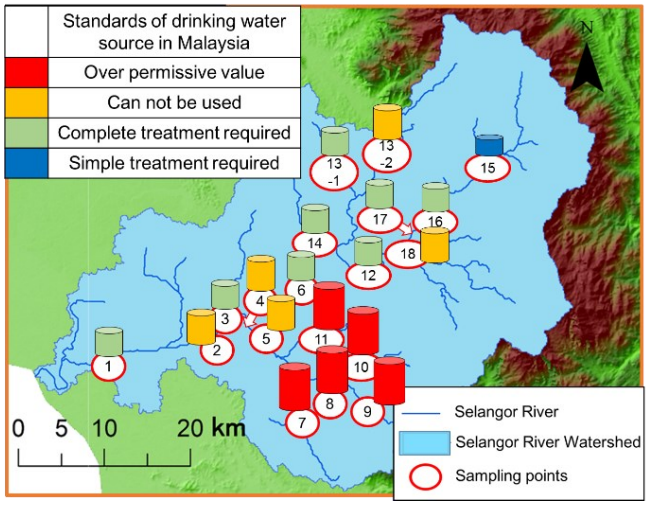


Figure 2 Microorganism pollution level with river water quality standards in Malaysia.

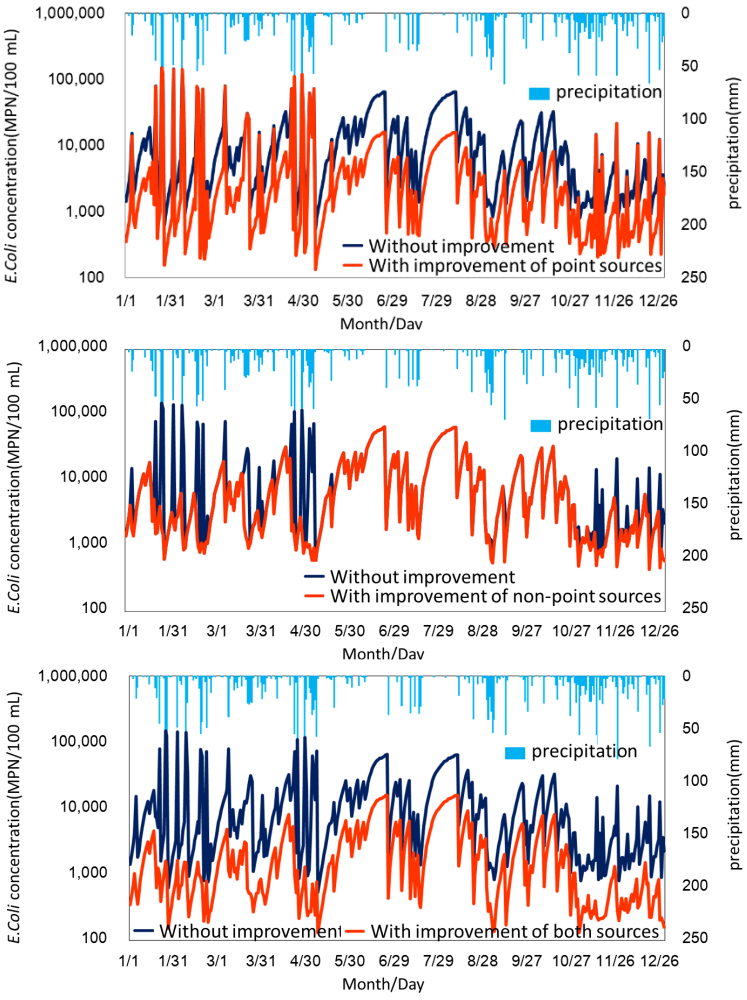


Figure 3 Annual trends and effects of *E.coli* concentration with countermeasures.

Results and Discussion Figure 2 shows the results of *E.coli* concentrations measured in November 20-22, 2013. The color of cylinder means the microorganism pollution level compared with river water quality standards in Malaysia. It revealed that microorganism pollution was serious throughout the watershed. Furthermore, a considerable level of *E.coli* concentration (240,000 MPN/100 mL), which is almost similar to sewage influent, was measured at sampling point 8. Therefore, the water safety is threatened by microorganism pollution in the river. The GIS-based simulation could reveal the improvement of microorganism pollution by future scenario with some countermeasures. The GIS-based watershed model for microorganism pollution was formulated with using the data of both point or non-point sources caused by anthropogenic activities. Two scenarios were made to evaluate the improvements. One scenario focused on the point sources such as direct effluents from residence and/or septic tanks. Another one focused on non-point sources such as the manure fertilized to agricultural land. Sampling point 2 was chosen as it is located near the intake point of drinking water treatment plant providing water to KL. Figure 3 indicates the annual trends of *E.coli* concentration with some countermeasures. With improvement of non-point sources, *E.coli* concentration will decrease in wet season. On the other hand, with improvement of both point and non-point sources, it will decrease in both dry and wet seasons. Therefore, reduction of both sources is a key to improve the microorganism pollution all year around. Thus, the control microorganism pollution in all seasons requires a holistic countermeasure on both point and non-point sources.

Conclusions and Future Plan

The results of this research reveal that microorganism pollution in Selangor River watershed threatened the access to safe water, and the improvement of microorganism pollution requires reduction of both point and non-point sources. Therefore, effective countermeasures should be considered to protect safe water access of all the stakeholders. The GIS-based simulation is a helpful tool for stakeholders to consider countermeasures since the simulation clarifies the effectiveness of them. Further research is necessary to evaluate what countermeasures will have better and best effects for all the stakeholders. Actual conditions of the sources of microorganism pollutant must be fully understood to consider a holistic countermeasure in the future.

Water Quality Modelling for Johor River Basin Using Soil and Water Assessment Tool (SWAT) Model

26 October 2014 — 1 November 2014

Otsu, JAPAN

Assoc. Prof. Dr. Azmi Bin Aris
Institute of Environmental and Water Resource Management (IPASA), Department of Environmental, University of Technology Malaysia

Ainul Syarmimi Binti Rosli
Faculty of Civil Engineering, University of Technology Malaysia

Introduction and Objectives

In recent years, Malaysia is facing a lot of environmental issues related to pollution of the river. One of the factors effecting water quality is differences in land within the river catchment (Othman et al., 2013; Singh et al., 2005) such as urban area, agriculture, forest, and industrial area. Besides, the land covers are always changing every year, especially in the developing area. The quality of the river has been observed to decrease in certain location throughout the country yet to be decreasing over the year. Actions need to be taken by measuring the pollutants, predict their effect on water quality, determine the background of water quality that would be present without human intervention, and decide the levels acceptable for the intended uses of water. In order to control the discharge of pollutants in the river, applications of a water quality model and computer simulation can be used to evaluate and predict the future water quality of the river. Water quality modeling is an important tool that can be used in the management of river water quality. The objectives of this study are (1) to develop a water quality model for Johor River basin using ArcGIS and SWAT extension (2) to calibrate and validate the developed model using observed water quality data and (3) to forecast the effect of land use changes in the water quality of the Johor River using the developed model.This study was developed a GIS water quality model for the Johor River basin. In particular, Soil and Water Assessment Tools (SWAT), an extension in ArcGIS was used. Secondary data, such as meteorological data, land use and pollution sources and used to develop the river model system. The results of the simulation model were calibrated using observed data for the period of 2005 through 2007 while the period of 2008 through 2010 for the validation of both simulating and forecasting of flow and water quality parameters. Besides, two land use change scenarios were performed to identify the effect of land use change in the water quality of the Johor River using the calibrated model.

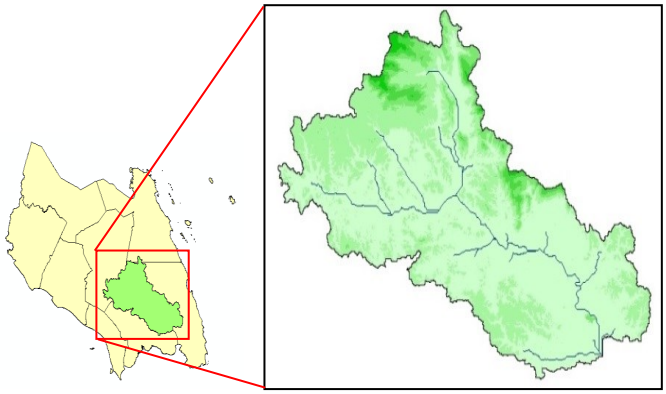


Figure 1: Study Region (a) Johor State (b) Johor River Basin

Remarks

"I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this study. A special thanks to A.P. Dr. Azmi Aris, Dr. Khalida and Dr. Shamila who help me to guide and collect the data needed for this research. I would like to acknowledge the support given by Universiti Malaya and Kyoto University. I also would like to thank to Dr. Azmi Aris, Dr.Yoshihisa Shimizu, Prof Md. Ghazali Shabaan, Dr. Nik Meriam, Mr. Azizi for giving me the opportunity to gain experience training in Kyoto University, Japan. For Mr. Takashi Kondo, Ms. Yu Kawata, Mr. Taishi Yazawa and Mr. Daisuke Mizuochi, my deepest and sincere appreciation towards all the things that all of you have done in helping me out using SWAT at Kyoto University. Finally, I would like to big thanks to Prof Yoshihisa Shimizu and his students for all their good hospitality during my stay at Otsu, Japan".

Results and Discussion

The simulated Ammonium, NH_4 was calibrated against the monthly NH_4 from 2005 to 2007 and validated from 2008 to 2010 at Rantau Panjang Station, as presented in figure. The model performed fit well with observed data. The fit between the simulated and observed NH_4 was satisfactory, according to Moriasi et al (2007). The calibrated parameters were accepted for the scenario simulations. Once the model has been developed, calibrated, and validated, the models were used to predict the effect of land use changes on the water quality of the Johor River basin. In this study, the following two land use change scenarios were applied. First scenario focused on the decrease of the forested area and the increase in the amount of agricultural area in the Johor river basin. Second scenario is also focused on expansion of urban areas and reduction of agriculture area especially Bandar Kota Tinggi area. Figure 3 indicate the mean monthly NH_4 values for first scenario. Based on the result, the NH_4 increasing within increasing the percentage of expansion of agriculture area following by rainfall event. Besides, an increase in NH_4 is observed during wet month and reduction during dry month. For scenario 2, Figure 3 showed the mean monthly NH_4 values for second scenario which is expansion of urban and reduction of agriculture. The form of changes is nearly similar to the one of the expansion of agriculture land scenario. In this case, the changes during dry month are significantly lower. This result can be mainly attributing to the type of applied land use changes.

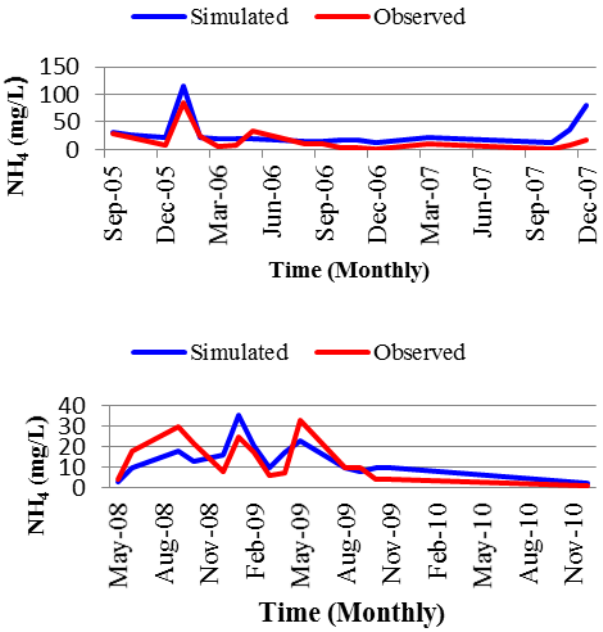


Figure 2: Observed and simulated monthly NH_4 at the Rantau Panjang station: (a) Calibration and (b) Validation.

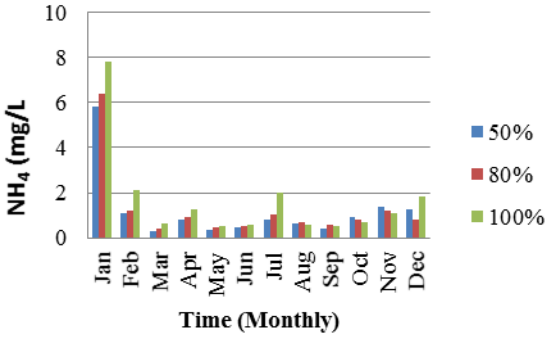


Figure 3: Effect of land use change for NH_4 in scenario 1

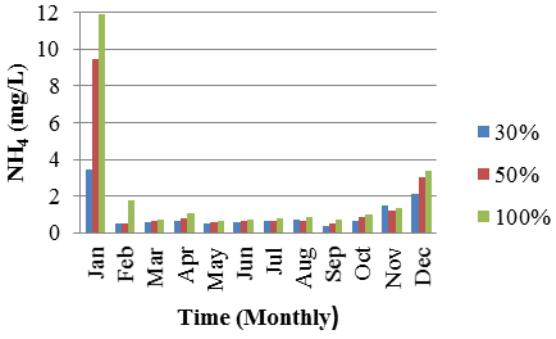
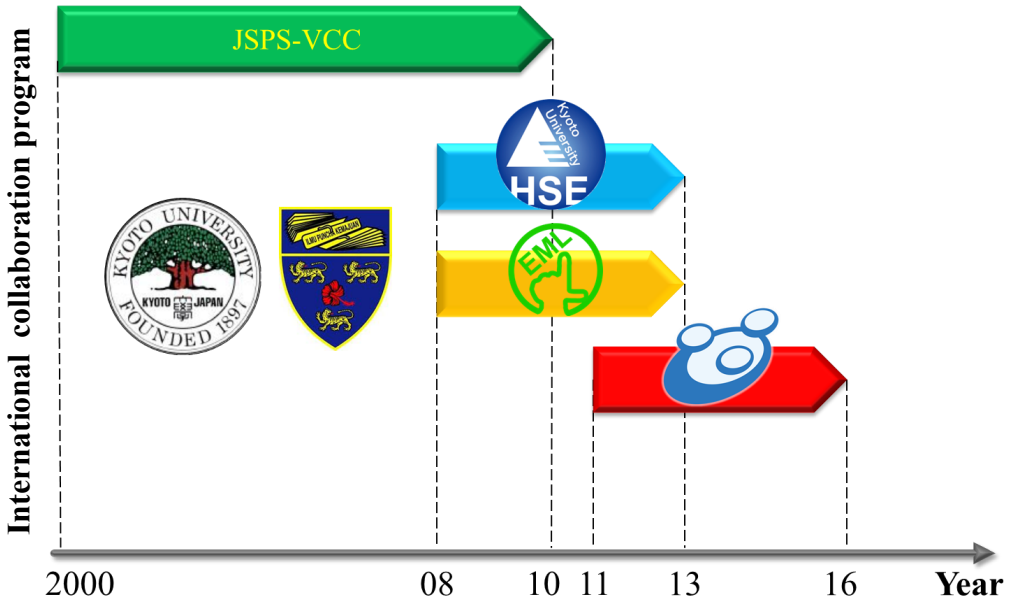


Figure 4: Effect of land use change for NH_4 in scenario 1

Conclusion and Future Plan

The main purpose of this study was forecast the impact of land use changes on water quality parameters (e.g.; NH4) by using calibrated and validation SWAT model. This study showed that the SWAT model can perform satisfactorily in simulation model for Johor River basin, Johor. Besides, the overall results also showed that the SWAT model could useful tool for forecasting the impact of land use changes on flow and water and water quality in the Johor River basin. All two scenarios of land use changes gave increasing value of NH_4 in Johor River basin. With those result, it can be conclude that, the land use changes was gave highly effect to the river. Further research is necessary to simulate by using other water quality parameters in Johor River basin with adding more requirement input data to get very good model development using SWAT.



Programs and its duration under international collaboration between Kyoto University and University of Malaya

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